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PRELIMINARY RESULTS OF THE OCEANOGRAPHIC CRUISE OF CCGS SIR JOHN FRANKLIN TO BAFFIN BAY AND NARES STRAIT, SEPTEMBER 1986

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This report describes the preliminary results of the cruise of the Canadian ice breaker CCGS SIR JOHN FRANKLIN to northern Baffin Bay and Nares Strait during September 1986. Over 175 CTD stations were made including 28 taken during a 36-hour time series. Closely spaced stations were acquired across Lancaster, Jones, and Smith Sounds. CTD data and bathymetric profiles were obtained throughout the length of Nares Strait (to 82° 09'N)). Three transects were also made across the West Greenland Current in which a moderately strong front was noted.

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PRELIMINARY RESULTS OF THE OCEANOGRAPHIC CRUISE OF CCGS SIR JOHN FRANKLIN TO BAFFIN BAY AND NARES STRAIT, SEPTEMBER 1986

by

Robert H. Bourke

I. INTRODUCTION

This interim report describes the cruise of the Canadian Coast Guard ice breaker SIR JOHN FRANKLIN to the region of northern Baffin Bay and Nares Strait during September 1986. This cruise has been designated Arctic East 1986 (AE86), but for continuity with past cruises is also termed MIZLANT 86. The cruise had two primary objectives: (a) to map the sea floor bathymetry of the area, principally in Nares Strait, and (b) to conduct CTD soundings in these waters to establish their circulation and water mass structure. Both of these objectives were completely met. The SIR JOHN FRANKLIN track covered over 5200 km (2800 nmi) providing almost continuous depth soundings over the entire track. Over 175 CTD stations were made including hourly casts made at a 36 hour time-series station. In addition, the water current was measured at three stations. Ten radiosonde balloons were also launched during the cruise to test the capability of using a newly-developed minisonde system under Arctic conditions.

II CRUISE OVERVIEW

The scientific party boarded the SIR JOHN FRANKLIN on 6 September 1986 in Resolute Bay on Cornwallis Island, Canada. The members of the scientific party and their affiliations are:

Prof. Robert H. Bourke, Naval Postgraduate School (NPS), Chief Scientist

LT Allan M. Weigel, USN, student at NPS

LT Victor G. Addison, USN, student at NPS

Mr. Patrick J. Barthelow, NPS

Mr. Robert K. Perry, Arctic Submarine Laboratory (ASL), NOSC, Chief Bathymetrist

Dr. Edward R. Floyd, ASL

Dr. Burton Markham, ASL

Mr. Kim O. McCoy, consultant to Polar Research Laboratory

The cruise was initially scheduled to be conducted aboard the US Coast Guard ice breaker NORTHWIND. However, due to sovereignty issues with Canada concerning passage through the restricted waters of the Canadian Archipelago the cruise was shifted at the last minute to the SIR JOHN FRANKLIN. This necessitated delaying the cruise by approximately two weeks, a delay quite substantial when considering the need to traverse the length of Nares Strait near the commencement of the freezing season. Fortunately, ice and weather conditions permitted passage through all of Nares Strait to the mouth of the Lincoln Sea, despite the lateness of the sailing date.

The MIZLANT 86 cruise was considered to be an international cruise by all governments concerned. The Canadian government invited Dr. Peter Jones of the Bedford Institute of Oceanography to participate. Dr. Jones is a chemical oceanographer whose prinicipal interest in the cruise was to confirm from water mass analysis that the deep water in Nares Strait is the source water for Baffin Bay Deep Water. Dr. Jones was a definite asset in assisting with the understanding of the oceanography of these waters, especially in northern Baffin Bay and its associated sounds. The Canadians have carried out an active research program over the past several years in these waters.

The Danish government provided CDR Eric Thomsen, the Danish Liaison Officer at Thule, Greenland, to act as their official representative. His presence aboard was mainly brought about because the proposed cruise track penetrated inside the 3-mile territorial limit of Greenland during our passage up Nares Strait. CDR Thomsen boarded the ship in Thule and left by helicopter 5 days later. CDR Thomsen was of great assistence in facilitating the loading and off-loading of our oceanographic equipment in Thule.

The ship sailed from Resolute Bay on 6 September setting course for the entrance of Lancaster Sound where we commenced oceanographic observations the following day. The cruise track and location of CTD stations are indicated in Figure 1. A listing of the location of all CTD stations and the water depth at each station is shown in Table 1. A series of closely-spaced stations were made across Lancaster, Jones and Smith Sounds to establish the inflow rate and water characteristics of the waters flowing into Baffin Bay.

On the morning of 10 September the ship tied up at the pier in Thule, Greenland to take aboard the oceanographic equipment which had been shipped earlier to Thule, expecting it to be our port of departure. We departed Thule later that day and headed for the entrance of Smith Sound. On 12 September we commenced our CTD survey of Nares Strait. Detailed bathymetric recordings commenced at this time also. Nares Strait was traversed northward using a zig-zag path to sample the bathymetry across the width of the Strait. On 18 September the ship reached the entrance of the Lincoln Sea (81° 09'N). Further northward progress was impeded by the presence of thick multiyear ice wedged in the northern throat of Kennedy Channel. This ice was heavily ridged, resembling a rubble field with 10/10 ice concentration. We returned south the next day continuing with CTD and bathymetric sampling. On 24

September we exited Smith Sound enroute for Melville Bay where we conducted three transects across the West Greenland Current. On 27 September the ship anchored off Thule. Equipment and scientific personnel were offloaded on 29 September.

III. INSTRUMENTATION

Normally the primary oceanographic instrument is the Neil Brown Instrument Systems (NBIS) Mark III CTD. However, the SIR JOHN FRANKLIN is not outfitted to routinely conduct oceanographic observations. Hence, no oceanographic winch wrapped with conducting-wire cable was installed which necessited using our backup instrument, the light-weight, portable Applied Micro Systems CTD, as our principal measuring device. This instrument has an internal self-recording mode allowing the data from a cast to be dumped to a computer upon completion of the cast. The CTD was lowered and retrieved using a battery-driven portable winch with 1000 m of nylon line spooled on it. Prior to entering the ice-covered waters of Nares Strait the nylon line was replaced by a stronger four-conductor Kevlar strengthened line. Although sending data up the wire was possible with this line, we chose to continue in the autonomous data collection mode as it provided for faster data transfer.

Three Applied Micro Systems CTD were available, serial numbers 422, 433, and 467. Because of the short lead time, only one of these CTD's (#433) was calibrated prior to the cruise. In order to establish a calibration between the three CTD's, nine stations were occupied at various times throughout the cruise wherein two or three instruments were strapped together and lowered simultaneously. Preliminary analysis indicates that temperature and salinity profiles from all instruments reproduce identical curves (within a degree of accuracy requisite for our needs), being offset by constant additive

corrections which must be calculated for each instrument.

Because of the closeness of the data processing computers to the ship's radio transmitter, large fluctuations in line voltage were experienced. This caused a failure in the pressure sensor board of CTD 467. Later in the cruise the conductivity sensor of CTD 422 was cracked but was replaced with the conductivity sensor of CTD 467.

Approximately half way through the cruise the air temperatures became considerably colder, varying between -8°C and -10°C. This caused icing to occur in the pressure and conductivity sensors when transporting the CTD's from the laboratory to deck edge. After this condition was noted, further occurrences were prevented by insuring these sensors were blown dry prior to exposing them to the cold air.

The depth resolution of the CTD's was nominally set to approximately one sample per meter, about three times coarser than we have used in the past with the NBIS CTD. This coarse depth resolution was necessitated by the slow rate at which the CTD buffer was down-loaded into the computer memory for transfer to disk. At this depth resolution it took about an hour to dump a 400 m cast, including both down and up traces. Due to our station pattern, especially the closely-spaced ones or the deep water ones, we were forced to generally record the down-trace and only a portion of the up-trace prior to the commencement of the next station.

The portable winch used for CTD hoisting was barely adequate for the task. Lowerings were conducted by free-falling the CTD at a 60 m/s rate. However, hoisting had to be supplemented by one or two people hauling in on the line whenever a stabilizing weight was added to the CTD or several CTD's were lowered simultaneously. Early in the cruise the winch drum was squeezed

and distorted beyond repair due to the extreme line tension. The drum was replaced by the SIR JOHN FRANKLIN engineers using a 1/4 inch steel wall cylinder. Also, instead of running the winch on battery power, we ran it directly from a battery charging unit that provided a three-speed capability. For future use in a ship-board mode of operation (rather than helicopter or ice floe mode) the winch motor should be increased in capacity by at least a factor of two.

IV DISCUSSION

A. Temperature-Salinity Transects

A series of closely-spaced CTD stations was occupied across the mouths of Lancaster, Jones, and Smith Sounds (Fig. 1). These stations will provide water mass characteristics and baroclinic current estimates for these constricted waters which are the primary source of Arctic Ocean water flowing into Baffin Bay. Because the data have not yet been corrected for calibration errors, only relative comments can be cited at this time.

The near surface waters (approximately upper 50 m) of each of these sounds is appreciably fresher (>1 ppt) on the left-hand side of the channel (as viewed from Baffin Bay). In Lancaster and Jones Sounds this buoyant near-surface lens acted to trap solar heat permitting temperatures to rise above 0°C. Relative dynamic topographies suggest most of the Arctic Ocean water influx occurs only to mid depth and is concentrated along its southern margins. In Smith Sound, on the other hand, near surface waters warm appreciably proceeding from west to east (from -1.5°C to >0°C). Thus, the dynamic height difference across Smith Sound is reduced relative to the other two sounds. Also, one notes that at most stations the maximum temperature was found at depths ranging from 10 to 50 m below the surface, indicating that

winter cooling had already commenced before early September. The exception was in central Baffin Bay, well removed from sources of cold water and the presence of ice, where deep (~ 50 m) isothermal conditions prevailed.

Three transects were also conducted across the West Greenland Current (WGC) near Melville Bay. These show the existence of a moderately strong front centered near Stations 126, 137, and 141. Stations to the east of the front exhibit the characteristically warm and salty (>0°C, >33 ppt) conditions normally associated with the WGC. To the west of the front the surface was ice covered, a mixture of predominately old rotten ice and newly formed thin ice.

A cursory examination of the near-bottom temperature and salinity characteristics throughout the length of Nares Strait shows that, as expected, the waters become warmer and saltier proceeding northward. Near the northern end of Nares Strait the bottom waters have nearly the same temperature-salinity characteristics as the waters which make up the Atlantic layer of the Arctic Ocean. Precise sensor calibration will be required to demonstrate the relationship of the bottom waters in the strait to the Atlantic layer water and also to monitor its dilution and cooling as it flows southward through Nares Strait.

B. Current Meter Measurements

The water current was planned to be sampled at several locations at depths between 50 and 100 m depth using a savonious rotor current meter suspended over the side of the drifting ship. This would provide a relative velocity shear which could later be employed to correct relative (baroclinic) currents computed from dynamic topography to absolute values. Measurements planned for Lancaster and Jones Sounds had to be omitted due to the change in

port of embarkation (Resolute Bay instead of Thule, where the current meter was previously shipped).

The current meter was first used at Station 40 in the center of Smith Sound. Measurements of speed and direction (actually voltages) were digitally recorded, sampling every 30 sec and averaging every 10 min, for 2 hours at 100 m, and 10 min at 80, 60, and 40 m depth. As yet, none of the current meter data have been converted to engineering units nor have corrections due to ships drift been applied. During this period the current speed and direction, as estimated from ship's drift, was southward at 0.35 kts. Also, in setting up the current meter it was found that the underwater connectors on the direction sensor were broken. Temporary repairs were made.

Current meter measurements were next made in Robison Channel (Station 106) and in Kennedy Channel (Station 108). Samples were acquired every 30 sec for 10 min at 100, 80, 60, and 40 m. The ship drifted southward at approximately 0.3 kts during these observation periods.

At Station 115 in the center of Smith Sound a 36-hour time series was conducted. The current meter was initially positioned at 40 m depth with a CTD positioned just above it. Measurements were made every minute for 6 hours. The meter was then lowered to 80 m depth for the remainder of the time series using the same sampling rate. The ship was initially wedged in between two large ice floes. However, due to the rapid southward drift of the floes, about halfway through the time series the ship started rolling heavily as it had drifted to the edge of the ice margin in Baffin Bay. The ship was then re-positioned 2 miles northward and again wedged between two massive floes.

C. Upper Air Soundings

The ability to plan for or carry out a helicopter launch from a Coast Guard ice breaker operating in the Arctic is often fraught with frustration

due to unforeseen changes in weather patterns. These changes can often be anticipated if upper air soundings are made, a capability not presently available to the ice breakers. Recently, a miniaturized upper air sounding system has been developed by the VIZ Instrument Company in conjunction with researchers at the Naval Postgraduate School. The WL-8000 RP+ radiosonde data acquisition system was operated from the SIR JOHN FRANKLIN to test the feasibility of using this system in an arctic environment and with personnel having a minimal amount of training in its operation. The system consists of balloon-launched rawinsondes, which are tracked by navigation aids such as LORAN or OMEGA, and a data acquisition system built around an APPLE IIe computer. The WL-8000 RP+ system sells for $35,000, two or three times less than radar tracking systems.

Ten radiosonde launches were attempted during the period 7-18 September 1986. Nine of the flights provided useful meteorological data; the one unsuccessful flight was attributed to operator error. The system was simple to operate and structurally reliable enough for arctic at-sea operations. The entire launch operation can be conducted by one or two people.

LORAN courage in the area of operations was essentially non-existent; hence it was not possible to track the rawinsonde. This eliminated obtaining vertical profiles of wind speed and direction. More recent versions of the WL-8000 RP+ system now include the OMEGA navigation system as an option thus alleviating this problem in LORAN-poor areas. Thermodynamic profiles were obtained and skew T/log P plots produced. These were transmitted to Canadian Coast Guard Headquarters in Ottawa for use by Canadian meteorological agencies.

D. Bathymetry - by Robert K. Perry

Introduction:

During Arctic East 1986 bathymetric surveys were conducted aboard the Canadian icebreaker SIR JOHN FRANKLIN in the Kane and Hall Basins, and in Kennedy and Robeson Channels. In addition to these areas, extensive survey lines were run in northern Baffin Bay. Members of the bathymetric survey team were Robert K. Perry, Burton Markham and Edward R. Floyd of the Arctic Submarine Laboratory, San Diego, CA.

Method:

The survey line spacing in Smith Sound, Kane Basin, and Hall Basin ranged between 10-20 nmi. In northern Baffin Bay survey lines consisted of two transects across the Bay, three radial lines in Melville Bay, and a detailed survey of an enclosed basin south of Smith Sound. The depth recorders aboard SIR JOHN FRANKLIN were Kelvin Huges Navigational Echo Sounders, type MS-45 with depth ranges of 0 to 40 m and 0 to 4000 m. The recorders were phase adjustable and hence any portion of 0 to 40 m or 0 to 400 m depth scale could be selected for display. Ship transducers were 30 kHz and 45 kHz with a beam coverage of 17° fore and aft and 25° athwart ship. The recorder-transducer systems were intermediate water depth type equipment with a maximum depth range of 1600 m. Navigation equipment consisted of a Magnavox Satellite Navigator MX 1112. Satellite fixes were obtained approximately twice per hour.

Results:

During AY86 approximately 2800 nmi of survey lines were obtained. The unique aspect of these data is that they represent the first large body of soundings in Kane and Hall Basins controlled by satellite navigation. Many shallow water areas were mapped for the first time and new bathymetric

features were delinated. A summary of area bathymetry surveyed is given below.

Smith Sound Between 78° N and 79° N seven transects were sounded in Smith Sound. The bathymetry consists of a southward sloping trough ranging in depth from 400 m in the north to over 800 m in the south. The trough is approximately 25 nmi wide and 50 nmi long. The floor of the trough was discovered to have localized mound-like elevations or broad-based sea knolls of 455 m and 300 m, respectively. Two glacial valleys (Cadogan and Baird Inlets) intersect the trough from the west.

Kane Basin Six transect lines were surveyed in Kane Basin. The basin is approximately 50 nmi wide and 90 nmi long. The bathymetry of the basin consists of two troughs separated by a broad, gently sloping ridge extending southward from Cape Jackson (80° 03' N, 67° 10' W) to 78° 50' N. The ridge roughly divides the basin into two equal parts. Survey lines run in the eastern half of Kane Basin revealed a steep-sided trough over 400 m deep lying adjacent to the Greenland coast. The trough extends from Rensselaer Bay (78° 40' N, 71° 10' W) to the head of Peabody Bay (79° 30' N, 65° 30' W). In the western portion of Kane Basin survey lines revealed a continuous trough of 250 m depth linking Baffin Bay with Kennedy Channel. This trough in effect eliminates Kane Basin as an oceanographic basin as bottom water is not trapped within Kane Basin. A localized depression was discovered in the southern tip at the Cape Jackson Ridge. The depression is approximately 30 nmi long and 5 nmi wide with a relief of 50 m. Six crossings of the depression were made by SIR JOHN FRANKLIN.

During the surveys of Kane Basin SIR JOHN FRANKLIN obtained the first soundings within Rensselaer, Marshall, and Dallas Bays with depths as shallow as 30 m being recorded.

Kennedy Channel Seven transect lines were sounded across Kennedy Channel. The channel is approximately 20 nmi wide and 85 nmi long. The general floor depth is 380 m with the west side of the channel being deeper than the east side.

Hall Basin Three transects were sounded across the western portion of Hall Basin. Due to very heavy ice conditions in the eastern half of Hall Basin, no soundings were attempted in this part of the basin during this phase of the operations. A new maximum depth of 850 m was recorded for Hall Basin and the axis of the basin was determined to contain at least two "v" sided troughs. The central axis of the Hall Basin complex of troughs extended well into Robeson Channel with depths of over 600 m being recorded.

Northern Baffin Bay Extensive survey lines were run in the northern portion of Baffin Bay. Transect lines were run across the eastern ends of Lancaster and Jones Sounds. Three radial lines were run in Melville Bay. In addition, a distinct oceanographic basin was discovered lying between Smith Sound (78° 20' N, 74°00' W) and the Carey Islands at 76° 50' N, 75°00' W. Eleven transect lines were run across the basin and they revealed the feature to be 90 nmi long, 30 nmi wide, with a northern sill depth of 500 m and a southern sill depth of 580 m. The deepest portion of the basin was over 700 m.

E. Biological Sightings

One of the cruise objectives, albeit a minor one, was to conduct a population survey of the beluga whale. During the duration of the cruise not a single whale, of any species, was sighted. In fact, the entire region seemed quite devoid of any wildlife except for sea birds. No polar bears or walrus were sighted. Seals were occasionally observed in Nares Strait.

V. CONCLUSION AND RECOMMENDATIONS

The last minute change from using a US ice breaker to a Canadian ice breaker necessitated a change in logistical arrangements and instrumentation. We were fortunate to be able to adapt to these changes and thus meet all the goals and objectives of the previously established cruise plans. Chief among the factors that lead to such a successful cruise was the availability of the mini CTD's and the portable winch. The assistance of the Arctic Submarine Laboratory in this effort is recognized and appreciated.

Two recommendations arise from this cruise. Firstly, a more powerful portable winch wound with multiconductor wire should be acquired and be made available for future cruises. Even when operating from a ship equipped with a standard oceanographic winch, it is often necessary to have a second winch which will permit simultaneous current meter, conductivity-temperature chain, or time series (stationary or profiling) measurements to be made. It is obviously needed when operating from ships not equipped with an oceanographic winch or when installed winches are out of commission.

The second recommendation concerns the future use of Canadian ice breakers. These vessels are essentially an untapped resource. Many weeks of their arctic deployment are spent at anchor or drifting around waiting for vessels to be escorted into an ice-covered harbor. Participation in scientific cruises is readily welcomed to relieve the boredom. The ice breakers are new, comfortable, and powerful enough for most any season or location we might send them. The necessary conversions required to make them more compatible to carry out oceanographic research are minimal and easily accomplished. The cost of operating from one of these vessels is unknown to the author. The need to support US ice breaker committments is also recognized. However, the Canadian ice breaker is a resource that should not be overlooked when confronted with ship scheduling problems.

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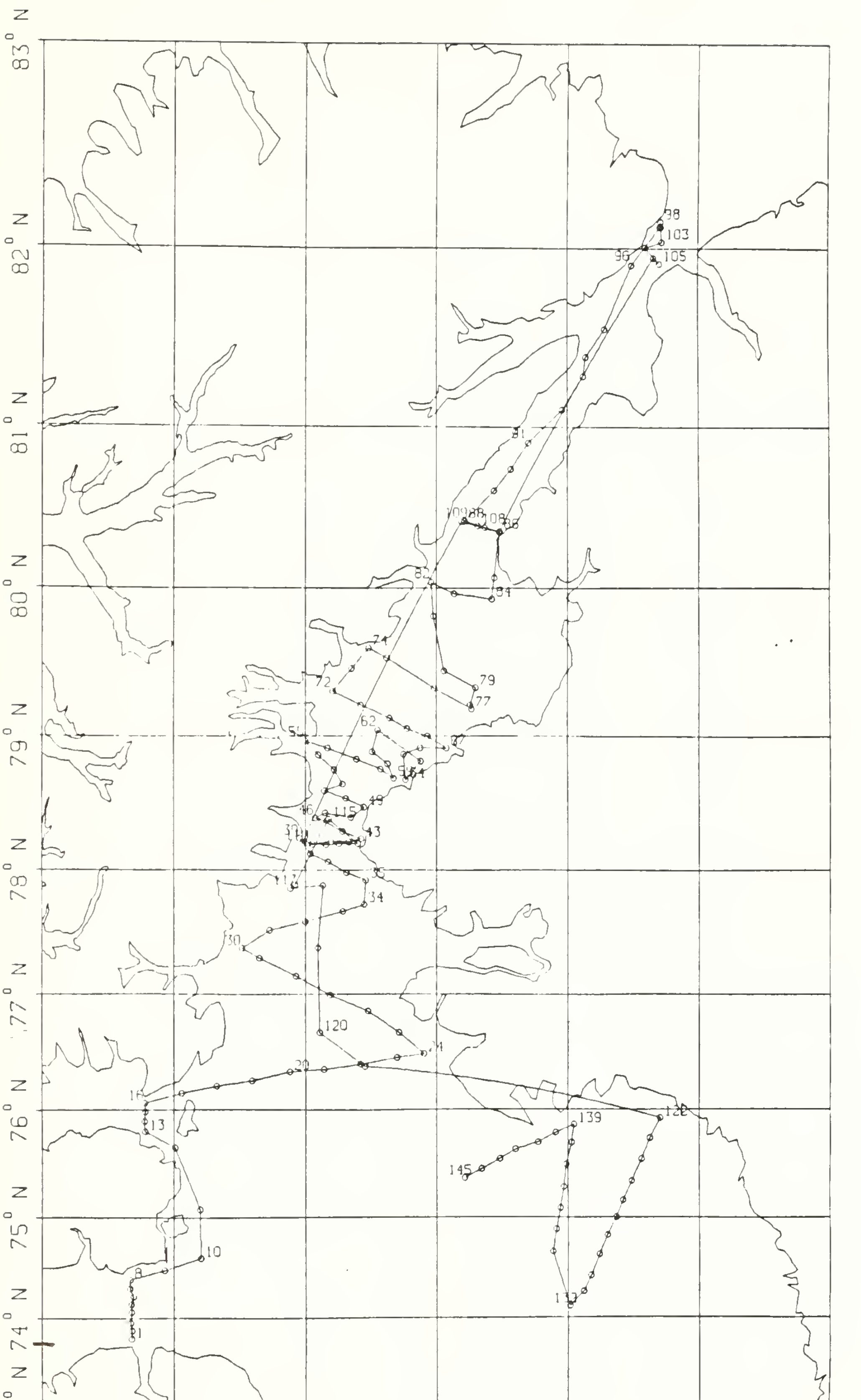

Figure 1. Cruise track and location of CTD stations during MIZLANT 86.

Table 1. Station Locations During MIZLANT 86

STATION NUMBER	LATITUDE	LONGITUDE	YEAR	MONTH	DAY	TIME	DEPTH
1	N73 47.3	W081 36.5	86	09	07	120	577
2	N73 52.2	W081 35.5	86	09	07	135	687
3	N73 57.2	W081 38.5	86	09	07	150	627
4	N74 03.7	W081 36.5	86	09	07	170	727
5	N74 08.5	W081 37.0	86	09	07	187	765
6	N74 13.2	W081 32.1	86	09	07	201	782
7	N74 18.1	W081 40.0	86	09	07	213	717
8	N74 23.5	W081 39.2	86	09	07	228	687
9	N74 29.0	W080 20.8	86	09	08	017	658
10	N74 36.4	W078 58.6	86	09	08	047	512
11	N75 04.7	W079 00.3	86	09	08	088	527
12	N75 39.4	W079 57.0	86	09	08	170	557
13	N75 48.4	W081 06.0	86	09	08	194	522
14	N75 54.0	W081 07.3	86	09	08	205	582
15	N75 59.1	W081 05.5	86	09	08	218	637
16	N76 03.9	W081 06.8	86	09	08	233	682
17	N76 09.1	W079 42.6	86	09	09	027	137
18	N76 12.8	W078 23.0	86	09	09	060	157
19	N76 15.6	W077 02.5	86	09	09	083	297
20	N76 20.4	W075 35.9	86	09	09	105	332
21	N76 21.8	W074 17.2	86	09	09	125	469
22	N76 24.5	W072 53.9	86	09	09	146	602
23	N76 27.8	W071 30.4	86	09	09	174	517
24	N76 29.8	W070 28.5	86	09	09	201	102
25	N76 40.7	W071 26.0	86	09	10	210	647
26	N76 51.6	W072 37.0	86	09	10	235	227
27	N76 59.6	W074 03.1	86	09	11	013	492
28	N77 09.1	W075 21.2	86	09	11	035	557
29	N77 18.0	W076 44.8	86	09	11	066	457
30	N77 22.8	W077 24.0	86	09	11	081	127
31	N77 31.5	W076 21.5	86	09	11	111	372
32	N77 35.7	W074 59.9	86	09	11	129	657
33	N77 40.6	W073 34.5	86	09	11	150	237
34	N77 43.9	W072 45.8	86	09	11	162	132
35	N77 55.3	W072 42.0	86	09	11	209	77
36	N77 58.8	W073 26.1	86	09	11	220	237
37	N78 04.0	W074 07.9	86	09	11	234	717
38	N78 07.8	W074 48.5	86	09	12	015	647
39	N78 14.7	W075 12.8	86	09	12	037	207
40	N78 12.1	W074 43.8	86	09	12	050	
41	N78 13.2	W074 01.2	86	09	12	136	687
42	N78 13.1	W073 20.5	86	09	12	159	477
43	N78 14.5	W072 52.5	86	09	12	172	107
44	N78 17.9	W073 35.0	86	09	12	184	607
45	N78 23.0	W074 22.0	86	09	12	205	347
46	N78 24.0	W074 37.2	86	09	12	222	507
47	N78 26.2	W074 14.8	86	09	13	005	
48	N78 24.2	W073 15.8	86	09	13	026	
49	N78 28.8	W072 46.0	86	09	13	030	247
50	N78 32.8	W073 28.0	86	09	13	050	
51	N78 36.2	W074 16.0	86	09	13	085	235
52	N78 39.1	W073 35.0	86	09	13	098	297
53	N78 45.5	W073 54.5	86	09	13	113	417
54	N78 51.9	W074 30.1	86	09	13	132	227
55	N78 57.9	W075 00.0	86	09	13	143	352
56	N78 54.8	W074 09.0	86	09	13	163	382
57	N78 50.1	W073 03.0	86	09	13	185	442
58	N78 45.7	W072 08.0	86	09	13	212	437
59	N78 41.6	W071 38.0	86	09	13	223	117
60	N78 48.0	W071 52.0	86	09	13	236	412
61	N78 53.2	W072 27.0	86	09	14	010	242
62	N79 02.4	W072 14.8	86	09	14	022	197
63	N78 49.2	W070 36.1	86	09	14	050	367
64	N78 41.0	W071 11.0	86	09	14	085	77
65	N78 52.2	W071 15.5	86	09	14	100	357
66	N78 54.9	W070 37.0	86	09	14	115	392
67	N78 54.8	W069 37.5	86	09	14	130	87
68	N78 59.8	W070 21.0	86	09	14	143	247
69	N79 02.9	W071 07.3	86	09	14	156	162
70	N79 07.4	W071 47.5	86	09	14	166	177
71	N79 13.1	W072 53.0	86	09	14	185	262
72	N79 18.8	W073 57.8	86	09	14	210	177
73	N79 28.2	W073 14.5	86	09	14	235	187

STATION NUMBER	LATITUDE	LONGITUDE	YEAR	MONTH	DAY	TIME	DEPTH
74	N79 36.5	W072 35.1	86	09	15	013	
75	N79 32.5	W071 54.1	86	09	15	040	252
76	N79 20.0	W070 05.3	86	09	15	070	237
77	N79 11.3	W068 39.5	86	09	15	100	297
78	N79 13.0	W068 43.0	86	09	15	137	387
79	N79 20.3	W068 30.6	86	09	15	155	
80	N79 27.3	W069 43.2	86	09	15	200	227
81	N79 49.2	W070 07.3	86	09	16	015	232
82	N80 02.2	W070 11.9	86	09	16	041	202
83	N79 58.0	W069 19.8	86	09	16	056	252
84	N79 55.9	W067 54.1	86	09	16	070	117
85	N80 04.1	W067 48.2	86	09	16	093	227
86	N80 21.7	W067 36.0	86	09	16	115	162
87	N80 23.1	W068 09.8	86	09	16	136	
88	N80 25.6	W068 56.0	86	09	16	195	
89	N80 36.8	W067 48.5	86	09	16	236	357
90	N80 44.7	W067 10.0	86	09	17	027	347
91	N80 54.4	W066 30.0	86	09	17	068	422
92	N81 06.1	W065 12.7	86	09	17	100	422
93	N81 17.8	W064 24.5	86	09	17	133	447
94	N81 24.3	W064 18.5	86	09	17	163	622
95	N81 33.7	W063 35.2	86	09	17	203	767
96	N81 54.5	W062 33.2	86	09	18	020	662
97	N82 06.7	W061 27.8	86	09	18	053	607
98	N82 08.3	W061 26.0	86	09	18	095	562
99	N82 07.0	W061 26.5	86	09	18	120	607
100	N82 06.7	W061 25.8	86	09	18	141	607
101	N82 06.8	W061 26.2	86	09	18	147	552
102	N82 08.8	W061 20.0	86	09	18	155	537
103	N82 02.0	W061 23.1	86	09	18	183	562
104	N82 00.3	W062 00.9	86	09	18	195	592
105	N81 55.1	W061 28.6	86	09	18	215	737
106	N81 56.9	W061 42.4	86	09	19	016	562
107	N80 21.4	W067 37.0	86	09	20	013	182
108	N80 23.7	W068 25.7	86	09	20	067	377
109	N80 25.3	W069 03.3	86	09	20	083	347
110	N78 12.3	W075 07.4	86	09	21	197	207
111	N78 12.6	W074 52.7	86	09	21	210	587
112	N78 11.9	W074 12.4	86	09	22	033	627
113	N78 12.4	W073 43.4	86	09	22	000	677
114	N78 12.4	W072 59.9	86	09	22	013	212
115	N78 23.5	W074 06.4	86	09	22	070	437
116	N77 53.3	W075 23.7	86	09	23	170	592
117	N77 51.5	W075 34.2	86	09	23	185	597
118	N77 52.9	W074 19.6	86	09	23	210	707
119	N77 23.0	W074 31.1	86	09	24	077	717
120	N76 40.8	W074 27.0	86	09	24	163	557
121	N76 23.3	W072 43.6	86	09	24	205	547
122	N75 55.6	W061 29.0	86	09	25	140	527
123	N75 44.6	W061 52.7	86	09	25	158	437
124	N75 33.0	W062 11.5	86	09	25	173	1042
125	N75 20.7	W062 34.4	86	09	25	192	237
126	N75 09.8	W062 54.1	86	09	25	207	177
127	N75 00.2	W063 10.0	86	09	25	218	127
128	N74 49.6	W063 30.1	86	09	25	233	262
129	N74 38.1	W063 48.4	86	09	26	010	372
130	N74 25.5	W064 07.4	86	09	26	035	912
131	N74 16.0	W064 24.0	86	09	26	050	957
132	N74 07.1	W064 55.7	86	09	26	070	1600
133	N74 39.9	W065 34.7	86	09	26	105	1600
134	N74 53.2	W065 27.0	86	09	26	125	417
135	N75 05.4	W065 17.7	86	09	26	143	322
136	N75 17.3	W065 10.0	86	09	26	157	222
137	N75 29.9	W065 04.2	86	09	26	170	162
138	N75 42.1	W064 52.0	86	09	26	185	617
139	N75 52.0	W064 47.0	86	09	26	203	622
140	N75 47.5	W065 28.6	86	09	26	220	542
141	N75 42.2	W066 08.7	86	09	26	233	562
142	N75 38.3	W067 00.0	86	09	27	010	437
143	N75 33.0	W067 35.5	86	09	27	023	337
144	N75 27.3	W068 17.5	86	09	27	037	397
145	N75 22.3	W068 56.0	86	09	27	050	592

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